Declaration

SITE NAME AND LOCATION

Midway Landfill
Kent, Washington

CERCLIS Identification Number: WAD 980638910

STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedy for the Midway Landfill site, located in the City of Kent, King County, Washington. This Record of Decision (ROD) has been developed in accordance with the requirements of Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) of 1980, 42 USC §9601 *et seq*. (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the Administrative Record for the Site.

The remedy was selected by the U.S. Environmental Protection Agency. The State of Washington concurs with the selected remedy.

ASSESSMENT OF THE SITE

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy for the Midway Landfill site consists of:

1. Monitor to:
   a) ensure the remedial systems are working as designed,
   b) ensure progress is being made towards meeting the groundwater cleanup standards,
   c) ensure adequate containment is maintained when and if major changes are approved by Ecology in the operation of the site, and

d) demonstrate that the cleanup levels have been achieved.
Monitoring includes, but is not limited to, groundwater monitoring and landfill gas monitoring.

2. Continue to operate and maintain all remedial project elements required in the Ecology/City of Seattle 1990 consent decree, including the gas collection system, the multilayered cap, and the storm water collection system.

3. Institutional controls. Three types of institutional controls are included in the selected remedy: permanent notices in King County's real estate records, assurances in the 1990 consent decree that operation and maintenance of the containment and monitoring systems will continue if the ownership or control of the property should change; and annual notices to appropriate agencies, water districts and locally active well drillers so that no water supply wells are constructed or used in areas with groundwater contamination from the landfill.

This ROD also establishes cleanup levels for the groundwater down gradient from the landfill.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate for the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The remedy selected in this ROD does satisfy the statutory preference for treatment as a principal element of the remedy. Extracted landfill gas is flared as part of the existing landfill gas collection system.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted under CERCLA within five years of this Record of Decision to ensure that the remedy continues to be protective of human health and the environment.

DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this site.

Chemicals of concern (COCs) and their respective concentrations. (See Section 5.)

A baseline risk assessment for current conditions at the landfill was not prepared because the contaminants of concern, migration routes, and the risks to human health and the environment were characterized in RI/FS reports completed in 1990. However, there is a need for action because groundwater downgradient from the landfill still contains contaminants of concern above federal drinking water standards (MCLs.) (See Section 7.)

Cleanup levels established for COCs and the basis for these levels. (See Section 8.)

How the source materials constituting principal threats are addressed. Source materials constituting principal threats have not been identified at Midway Landfill. (See Section 4.)

Current and reasonably anticipated future land and groundwater use assumptions used in the ROD. (See Section 6.)

Potential land uses that will be available at the site as a result of the selected remedy. (See Sections 6 and 11.3.)

Annual cost estimates for the selected remedy. (See Section 11.2.)

Key factors that led to selecting the remedy. (See Section 11.1)

____

Charles E. Findley
Acting Regional Administrator, Region 10
United States Environmental Protection Agency

____

Date

Decision Summary

Midway Landfill
Kent, Washington

1. Site Name, Location, and Description

The Midway Landfill is located between Interstate-5 (I-5) and Highway 99, and between S. 252nd Street and S. 246th Street in Kent, Washington, directly east of the city of Des Moines. (Figure 1-1.) The landfill is approximately 60 acres in size with refuse buried on about 40 acres and at depths over 100 feet. From 1966 to 1983, approximately three million cubic yards of solid waste were deposited at the Midway Landfill. The landfill is now owned by the City of Seattle.

Because of the remedial work performed by the City of Seattle since 1985, environmental conditions have greatly improved. The landfill is now covered with a multilayered engineered cap, with a top layer of grass. The landfill is fenced and access is limited. A gas extraction system is in place and operating throughout the landfill. Because of these actions, potentially explosive landfill gas does not leave the landfill property and the quality of the groundwater leaving the landfill has greatly improved. The city's estimate of closure costs amounted to about $56.5 million as of 1995.

Land use in the landfill vicinity consists primarily of commercial activities and residential areas. Commercial establishments and light industry and manufacturing border both sides of Highway 99 in the area. Two elementary schools, Sunnycrest Elementary School and Parkside Elementary School, and a city park, Linda Heights Park, are within a half-mile radius of the site. Most of the nearby residences are detached single-family dwellings, with some multi-unit residential developments to the south and west. Several mobile home parks are also in the vicinity. A six-acre wetland, the Parkside Wetland, located to the east of the Parkside Elementary School and west of the landfill is a naturally occurring detention basin for local surface water runoff, primarily from the west side of Highway 99.

There are no wetlands, flood plains, rare, threatened or endangered species, or sites on or eligible for the National Registry of Historic places at the site. Storm water from the site drains into McSorley Creek, which is a salmon-bearing stream containing coho and chum salmon, steelhead and cutthroat trout. Coho salmon is a candidate for listing under the Endangered Species Act.

.

The State of Washington Department of Ecology (Ecology) has been the lead regulatory agency for the cleanup work at Midway Landfill since the mid-1980's. While the U.S. Environmental Protection Agency (EPA) has prepared and released a proposed plan and this ROD, EPA expects Ecology to continue to be the lead cleanup regulatory agency overseeing this remedial action. The work has been, and will continue to be, conducted by the City of Seattle.

2. Site History and Enforcement Activities

2.1. Site History through the 1990 Consent Decree.

From 1945 to 1966, the site of the current Midway Landfill was operated as a gravel pit. Originally, the pit was adjacent to a natural drainage basin often used as a settling pond. This basin, known as Lake Meade, was located northeast from the center of the present landfill. As the pit was mined, water was drawn from Lake Meade to wash silt and clay from the gravel and sand, and then returned to the lake. This silt and clay settled on the lake bottom. Near the end of the gravel pit operation, the lake was drained into the southern end of the gravel pit, depositing a layer of clay and silt into the bottom of the pit. This layer of fine materials currently underlies much, but not all, of the present landfill.

In 1966, the City of Seattle leased the site and began using it as a landfill. From 1966 to 1983, approximately three million cubic yards of solid waste were deposited there. The exact dimensions of the bottom of the landfill are not known. However, existing boreholes indicate that the solid waste extends as deep as 130 feet in some places.

The Midway Landfill was created primarily to accept demolition materials, wood waste and other slowly decomposing materials. However, some hazardous wastes and industrial wastes, including approximately two million gallons of bulk industrial liquids from a single source, were also placed in the landfill. In 1980, a state-mandated screening process administered by the Seattle-King County Department of Public Health was initiated to eliminate the disposal of any hazardous waste into Midway Landfill.

When the City closed the landfill in the fall of 1983, it began extensive testing of water and gas in the landfill and its vicinity. Samples of groundwater from monitoring wells in and around the landfill, and gas samples from gas probes, indicated the presence of organic and inorganic contaminants outside the landfill boundary. In 1985, Ecology also began investigating the site and found methane gas in nearby residences. Beginning in September 1985, the City of Seattle constructed gas migration control wells within the landfill property and gas extraction wells beyond the landfill property to control the subsurface migration of gas. Gas was found to have migrated up to 2600 feet beyond the landfill prior to installation of the gas extraction system.

In October 1984, Midway Landfill was nominated for inclusion on the federal National Priorities List (NPL) based on potential groundwater contamination. Following that nomination, Ecology was designated as the lead agency for the Midway Landfill Superfund action, pursuant to a Cooperative Agreement with EPA. In May 1986, Midway Landfill was placed on the NPL. In September 1988, the City of Seattle, which owns and had operated Midway Landfill, entered a Response Order on Consent with Ecology. This Response Order governed the preparation of a Remedial Investigation and a Remedial Action Feasibility Study (RI/FS) for the landfill.

In May 1990, prior to completion of the remedial investigation and feasibility studies, the City and Ecology entered into a consent decree pursuant to State of Washington Model Toxics Control Act (MTCA.) This legal agreement set forth Ecology's determination that undertaking certain remedial actions at Midway Landfill, prior to a Cleanup Action Plan (a MTCA decision document, similar to a Superfund ROD) would provide immediate protection to public health and the environment. In this consent decree, the City of Seattle agreed to finance and perform specific cleanup work. This cleanup work, or remedial action, had four elements:

- Construction of a landfill cover. The multi-layered Landfill Cover System ("cap") was to be comprised of layers (from bottom to top) of low permeability clayey silt/silty clay, a 50-mil synthetic membrane, a geonet drainage layer, one foot of sand and one foot of topsoil planted with shallow rooted grasses. The landfill cover was designed to greatly reduce the amount of rain that would seep into the landfill and to control the post-closure escape of hazardous emissions from the landfill.

- Completion of a gas extraction system, including a Final Gas Manifold System to link onsite extraction wells to an enhanced motor blower and flare system. The purpose of the onsite extraction wells was to create a "vacuum curtain" around the closed landfill to prevent offsite migration of landfill gas, and to help draw previously migrated gas back to the landfill. The enhanced flares were installed to burn the extracted gas before discharge to the atmosphere. The gas extraction system also included approximately 127 offsite gas monitoring probes to provide data on the extent of landfill gas migration and the effectiveness of the extraction system.

- Completion of a surface water management system. This system consisted of site filling and grading to control surface water drainage to prevent surface water from infiltrating the landfill, construction of a 10 million gallon storm water detention pond with a permanent dewatering system, a controlled discharge structure, and rerouting of storm water from surrounding areas to prevent it from entering the landfill. This rerouting was done by diverting the Linda Heights Park drain and surface water runoff from I-5 to the detention pond.

- Preparation of a comprehensive operation and maintenance manual incorporating both short-term and long-term operation and maintenance requirements for all remedial actions implemented at the landfill as part of the consent decree.

The consent decree also required the City to place a notice in the records of real property kept by the county auditor stating that the landfill was on the NPL, and serve a copy of the consent decree upon any prospective purchaser, lessee, transferee, assignee, or other successor in interest to the property prior to the transfer of any legal or equitable interest in all or any portion of the landfill.

2.2. Status of the work required by the 1990 Consent Decree

The City of Seattle completed construction of the landfill cover, landfill gas extraction system, and surface water management system in November 1992. Some of the other requirements of the consent decree have not yet been completed. Ecology and the City of Seattle anticipate amending the 1990 consent decree after this ROD is signed.

<u>Construction elements required by the 1990 Consent Decree</u>

Landfill Gas Control - An active gas control system was installed at the Midway Landfill. It originally included 87 gas extraction wells, 31 of which were located off the landfill in native soil. The off-landfill wells have since been abandoned or capped. In addition, approximately 70 off-landfill gas monitoring probes were installed to provide information on gas concentrations; about half of these probes have since been abandoned. The gas is extracted through the control wells at the landfill and routed to a permanent blower/flare system. Construction of the gas migration control system began in September 1985 and was completed in March 1991.

Landfill surface filling and grading - The landfill surface was regraded which increased the soil cover over the landfill by 2 to 14 feet. The engineered grades improved surface water runoff and decreased infiltration. The fill was also compacted to reduce permeability and prepare the surface for the cover system. The work began in August 1988 and was competed in June 1989.

Storm Water Detention Pond Construction and Associated Dewatering and Discharge System- A lined detention pond was constructed to the north of the landfill. Regrading of the landfill surface redirected surface water, which previously infiltrated into the landfill, to the new detention pond. The detention pond is a 3 acre structure, lined with a 60-millimeter high-density polyethylene membrane (HDPE) to eliminate infiltration. The bottom of the pond was constructed below localized groundwater; therefore, a permanent dewatering system was also installed. Construction of the storm water detention pond began in August 1988 and was completed in June 1989.

Landfill Cap Installation - Construction of the final landfill cover began in October 1989 and was completed in May 1991. It consists of the following layers from bottom to top: a 12-inch thick layer of low permeability (1 x 10-7 cm/sec) soil/clay material; a 50 millimeter HDPE flexible membrane; drainage net; filter fabric; 12-inch-thick drainage layer; and a 12-inch-thick topsoil layer.

Linda Heights Park Storm Water Diversion - The Linda Heights Park drain, a 30-inch culvert that drained directly into the landfill, was blocked. Storm water is now routed through a pump station and a pipeline to the detention pond. The old discharge line to the landfill is still in place and functions as an overflow in the event of a pump station failure. The construction of this rerouting began in August 1989 and was completed in 1991. The pump station and associated diversion of storm water was activated in January 1992.

<u>Non-construction elements required by the 1990 consent decree</u>

Operation and maintenance (O&M) plan - A comprehensive operation and maintenance manual for both short-term and long-term operation and maintenance for the systems constructed under the consent decree was prepared by the City of Seattle, and was approved by Ecology in April 1992.

Deed notice - The deed notice required by the consent decree has not yet been placed on the property.

Monitoring and monitoring plan - Monitoring and a monitoring plan are not specifically identified as required activities in the 1990 consent decree. An amendment to the consent decree will specify a requirement to implement a compliance monitoring plan approved by Ecology, as well as to implement an operations and maintenance plan already required to be prepared under the 1990 consent decree. The City of Seattle and Ecology are still in negotiations on the long-term monitoring plan. Starting in late 1989, the City initiated performance and compliance monitoring programs at the landfill. Performance monitoring (which did not include chemical analysis) was intended to track the response of landfill leachate levels and shallow groundwater levels to the implementation actions required by the consent decree. Quarterly water quality monitoring began in 1990 to develop a database for water quality in selected groundwater monitoring wells. This monitoring program, which became the compliance monitoring program, was modified in 1993 and again in 1998 with concurrence from Ecology. Compliance monitoring was intended to track the presence, concentrations and migration of groundwater contaminants both up gradient and downgradient of the landfill, and to assess the effectiveness of the remedial action. Both monitoring programs are ongoing and sampling is presently conducted on a twice yearly basis. Landfill gas monitoring is conducted frequently; it consists of checks for concentration, composition, temperature, flow and velocity of gases in and around the landfill.

3. Community Participation

Because of the high degree of public interest in the landfill, the City of Seattle and the Washington State Department of Ecology first developed a formal community involvement program in 1985 when residents near the landfill became concerned about landfill gas migration. Public meetings were held at critical points to keep residents informed about activities at the landfill. Also, for about two years, the City ran an information office in the Midway area to give citizens a convenient place to find out about cleanup activities, health information, and legal claims. As landfill gas migration was brought under control and residents' fears subsided, office hours were reduced and eventually the office closed. During the same period, a newsletter was sent to about 7000 area residents. The City and Ecology also worked with leaders from local active community groups to set up MAG (Midway Action Group) meetings, which were held monthly at first, and then less frequently. Through these meetings, community members could express their views and learn about the investigation and cleanup process.

The City created the Good Neighbor Program in 1986 to help the community when concern over landfill gas was at its peak. The program addressed fears about perceived drops in property values. The City guaranteed residents that their homes would sell for fair market value, as if the landfill was not there. The City continued the program until the real estate market returned to normal.

Very few formal community participation activities took place in the 1990's, though Ecology and City of Seattle staff continued to be available to respond to concerns and questions from the public.

EPA's proposed plan was issued in May 2000 and the original public comment period ran from

May 18 to June 16, 2000. Over 2,000 fact sheets summarizing the proposed plan were sent to all addresses and residents in the three postal carrier routes around the landfill. Additionally, the fact sheets were mailed to 48 other potentially interested parties (such as the Cities of Kent and Des Moines) outside the carrier route. Approximately two to three dozen copies of the proposed plan were sent out, and additional copies were available from EPA's Seattle office and at the City of Kent Regional Library. The fact sheet and proposed plan were also available on the Region 10 web page. Display notices were published in the Seattle Times, Seattle Edition on May 16, in the Seattle Times, South County Edition, on May 23, and in the South County Journal on May 17. The City of Seattle asked for an extension of the comment period on June 15, and the end of the public comment period was extended until July 17, 2000. Notices of the extension were published in the Seattle Times, South County Edition and the South County Journal on June 21.

The fact sheets, newspaper notices and the proposed plan offered to hold a public meeting if sufficient interest was expressed by May 31, 2000. Only four requests for a meeting were received and thus a public meeting was not held. EPA staff called each person who requested a meeting to make sure he or she had all the information they wanted about the Midway Landfill and the proposed remedial decision.

Four comment letters on the proposed plan were received. EPA's response to these comments can be found in the attached Responsiveness Summary.

This decision is based on the administrative record. The Midway Landfill Administrative Record is located at the EPA Superfund Records Center, 1200 Sixth Avenue, Seattle, Washington, and in the Kent Regional Library, 212 2nd Avenue N, Kent, Washington.

4. Scope and Role of this Response Action

This ROD is the final CERCLA decision for the Midway Landfill site.

The City of Seattle's cleanup work, including the work done in response to the 1990 consent decree between the City and Ecology, has successfully reduced the environmental problems at the landfill. The selected remedy incorporates elements required in the 1990 consent decree between City and Ecology, and adds some elements to ensure long-term protectiveness of the remedy. The selected remedy also sets groundwater cleanup standards.

The Midway Landfill site has no "principal threat" wastes, as that phrase is defined in EPA guidance.

For the purposes of this ROD and potential future deletion of this site from EPA's National Priorities List, the Midway Landfill "site" is the landfill area containing waste, and all downgradient contaminated groundwater resulting from releases from the landfill. Several potential up gradient groundwater sources have been identified but are not included within the "site" and are not addressed by this ROD.

Ecology has separate responsibilities for decision-making at the Midway Landfill site under the State's Model Toxic Control Act (MTCA). Under MTCA, the decision document that selects the cleanup action and cleanup levels is called a Cleanup Action Plan. Ecology and the city had been working on a final Cleanup Action Plan for Midway Landfill for many years. When, in February 2000 it was determined that it was unlikely that such a Cleanup Action Plan could be completed in FY 2000, Ecology agreed that EPA could write a CERCLA ROD for the landfill so that a determination of CERCLA construction completion could be made. Ecology has decided to utilize the ROD as a Cleanup Action Plan for a final MTCA remedy, pursuant to WAC 173-340-360(13). This decision will be specified in an anticipated amendment to the 1990 consent decree.

Ecology has been the lead regulatory cleanup agency at the Midway Landfill site. EPA expects Ecology to continue in that capacity.

5. Site Characteristics and Nature and Extent of Contamination

5.1. Conceptual Site Model and Summary of Landfill Conditions

Because of the remedial work performed by the City of Seattle at Midway Landfill since 1985, the environmental conditions at the site have greatly improved.

- Potentially explosive methane gas does not leave the landfill property, and has not since 1990. The gas is collected within the landfill and then burned on the site. The gas collection system has also helped dry out the landfill contents and further reduce the contaminated groundwater leaving the landfill.
- Storm water no longer enters the landfill. The entire landfill is covered with an engineered cap. Clean storm water is collected from the entire surface of the landfill and the surrounding area and stored in a lined storm water detention pond north of the landfill before discharge to McSorley Creek.
- There are multiple layers of sand, or sand and gravel, under or around the landfill that allow subsurface movement of groundwater to and from the landfill. These layers, or aquifers are called, in order from the surface to the deepest layers studied: the Shallow Aquifer; Saturated Refuse and Landfill Leachate; the Upper Gravel Aquifer, the Sand

Aquifer, and the Northern and Southern Gravel Aquifers.

- Water in the Shallow Aquifer, the Upper Gravel Aquifer and the Sand Aquifer moves from outside the landfill inward towards the south end of the Midway Landfill. This water, along with the leachate developed within the landfill itself, then joins the deeper Southern Gravel Aquifer. Water from the landfill does not appear to enter the Northern Gravel Aquifer.
- There is now significantly less water within the landfill because of the remedial actions described above. Many of the shallower monitoring wells in or near the landfill that used to contain contaminated groundwater are now dry. The water levels around the landfill in both the Upper Gravel Aquifer and the Sand Aquifer have also generally dropped. These results mean that much less water is entering the landfill and the containment systems constructed by the City of Seattle have been successful.
- The only downgradient monitoring wells where contamination has been detected over the past two or three years are in the Southern Gravel Aquifer. Two of these wells are located approximately 600 feet and 1200 feet east of the south-east corner of the landfill. Three chemicals, 1,2-dichloroethane, vinyl chloride, and manganese, have been detected at levels of concern. The two VOCs were detected at slightly above the federal drinking water standard. Manganese has also been detected at levels above background on the west side of the landfill in the Southern Gravel Aquifer.
- Another Southern Gravel Aquifer monitoring well that is closer to the landfill has met all federal drinking water standards for the past two years. Groundwater monitoring conducted during the RI indicated that this same well had contaminants at levels greater than 10 times the federal drinking water standard. Again, these results indicate that the containment remedy appears to be successful.
- There is some groundwater contamination in the Sand Aquifer to the north, northwest and west of the landfill that did not come from Midway Landfill. Some of the groundwater samples in this area are above both federal and state drinking water standards and the MTCA cleanup standards. This contamination may be flowing towards and under the Midway Landfill. No one is using this groundwater and thus no one is currently exposed to this contamination.

The following sections provide more detailed summary information about the site characteristics, hydrogeology, and groundwater quality.

5.2. Geographic Description

The Midway Landfill is located near the crest of a narrow north-south trending glacier feature known as the Des Moines Drift Plain. This area, referred to as "upland" because of its location above adjacent valleys and sea level, is bordered by Puget Sound on the west and the Green River valley on the east. Maximum elevations along the crest of the upland generally range from 400 to 450 feet above mean sea level (MSL). Puget Sound is at sea level, and the Green River valley floor typically averages about 30 feet above MSL.

The Midway Landfill occupies a shallow, bowl-shaped depression near the crest of the upland. The surface of the landfill generally ranges from 360 to 400 feet above MSL and slopes upward to the south and east. West of the landfill, the land surface is nearly flat across Highway 99 and then drops steeply downward approximately 100 feet to the Parkside Wetland.

The upland area is cut with a number of steep-sided stream valleys. Midway Creek is located northeast of the landfill, and two other streams, the north and south forks of McSorley Creek, are located to the west and southwest, respectively.

There is no major surface water body in the immediate vicinity of the Midway Landfill. The closest are Lake Fenwick, located approximately one mile to the southeast, and Star Lake, located approximately 1.5 miles to the south.

5.3. Geology

Site geology and hydrogeology have had a major influence on the movement of contaminants in the vicinity of Midway Landfill, the impact of the completed remedial actions, and affect the selection of the cleanup remedy.

The Des Moines Drift Plain is part of the Puget Lowland that lies between the Olympic Mountains on the west and the Cascade Mountains on the east. The Puget Lowland is underlain by a thick sequence of Quaternary glacial, fluvial (riverine), and lacustrine (lake bed) deposits overlying Tertiary volcanic and sedimentary bedrock. Depth to bedrock is thought to exceed 1,000 feet near Midway Landfill. Deposits of at least four glaciations have been identified in the Puget Sound Lowland. The most recent glaciation, the Fraser, consisted of two stages: the Vashon (oldest) and Sumus (most recent).

Based on earlier studies of the area and analysis of geological samples collected during the installation of monitoring wells for the RI, nine stratigraphically distinct deposits were identified from the land surface down approximately 400 feet to sediments that are near current mean sea level. Because of the complex layering in all the sediments underlying the landfill, vertical and horizontal permeabilities are highly variable and produce a complex groundwater flow pattern.

5.4. Hydrogeology and Ground Water Quality

Groundwater movement within and below the landfill has been characterized to an approximate depth of 300 to 350 feet below ground surface (50 to 100 feet above mean sea level (MSL)). Several groundwater units have been identified within this interval. From shallowest to deepest these aquifers are: Shallow Groundwater; Saturated Refuse; Upper Gravel Aquifer (UGA); Sand Aquifer (SA); and Southern Gravel Aquifer (SGA) and Northern Gravel Aquifer (NGA) An east-west cross section is shown in Figure 5-1; the line of this cross-section is H-H' on Figure 5-2.

Between October 1986 and January 1990, a total of 56 groundwater monitoring wells were installed and sampled in 41 locations up gradient and downgradient of the Midway Landfill . (Many wells have multiple completions at the same location). Samples from these locations were analyzed for conventional water quality parameters and EPA's hazardous substance list, including metals, volatile organic compounds (VOCs), pesticides and other potentially hazardous substances. Hazardous substances detected in the groundwater included arsenic, manganese, benzene, 1,2-dichloroethane, vinyl chloride, and methylene chloride.

In addition, the extent of contaminant migration into the groundwater system beneath the landfill was estimated using specific chemicals as indicators of leachate movement within the aquifers. In particular, chloride concentrations in the landfill leachate were several hundred times greater than background groundwater concentrations. Therefore, elevated chloride was used to delineate the extent of the contaminant plume and as a conservative tracer of groundwater movement. The concentrations of manganese (a naturally-occurring metal that is often elevated downgradient of landfills) and certain chlorinated ethenes and ethanes in the groundwater were also used to confirm the extent of the plume.

A subset of the RI groundwater monitoring network has been used for monitoring the effects of the work required by the consent decree. Figure 5-3 shows the locations of the monitoring wells still used to monitor groundwater quality. Water levels are monitored in these and additional monitoring wells.

Of the hazardous substances identified during the RI, only manganese and two VOCs, 1,2-dichloroethane and vinyl chloride, are still considered groundwater contaminants of concern. None of the other hazardous substances have been detected in groundwater at levels approaching federal drinking water standards downgradient of the landfill for at least eight years.

The sections below summarize, by aquifer, the hydrogeology and groundwater quality information collected during the past 10 years as part of the groundwater monitoring program. For comparison, averaged contaminant concentration data (arithmetic mean) from the RI are also included. Nondetects were incorporated into these averages by using half the detection limit.

5.4.1. Shallow Groundwater

5.4.1.1. Shallow Groundwater Hydrogeology

This zone of saturation was described in the RI as shallow, discontinuous lenses of groundwater perched on low permeability deposits above the UGA. Field work and data analyses since completion of the RI indicate while the groundwater in this unit is shallow and discontinuous, it is not always perched above low permeability materials. The majority of these shallow zones are found north and south of the landfill. The general water elevation of the shallow groundwater zone adjacent to the landfill is generally at about 325 feet above MSL north and south of the landfill, and lower, and more discontinuous to the east and west (Figure 5-4).

The landfill's detention pond dewatering system affects shallow groundwater flow through areas along the northern periphery of the landfill. Shallow groundwater north of the landfill that exists at 320 feet or higher in elevation is captured by the pond's dewatering system and routed to North McSorley Creek. This system limits the capacity of the shallow groundwater to discharge into the landfill from the north; however, groundwater deeper than 320 feet in elevation can and does discharge into the landfill from the north. Shallow groundwater also occurs in disconnected zones south of the landfill at an elevation of approximately 325 feet, and discharges, at least seasonally, into the landfill.

5.4.1.1. Shallow Groundwater Water Quality

Shallow groundwater water quality has not been monitored as part of the performance and compliance monitoring system. Shallow groundwater flows into the landfill.

5.4.2 Saturated Refuse and Landfill Leachate

5.4.2.1. Landfill Leachate Hydrogeology

Prior to the remediation required by the 1990 consent decree, the major sources of water to the landfill were: surface water infiltrating from the landfill surface and from areas north of the landfill that drained into the landfill; storm water discharge from the Linda Heights neighborhood, and I-5 drainage that was routed into the landfill as part of the construction of I-5; and shallow groundwater from north and south of the landfill. Refuse located below elevations of approximately 325 feet was generally saturated (Figure 5-5).

Flow in the refuse was generally from the north and west toward the south-central section of the landfill, where the pit excavations were deepest. Leachate may have discharged vertically throughout much of the landfill base, although the rate of discharge was affected by the fine-grained material deposited during gravel pit operations. Prior to remediation, the greatest volume of vertical flow was in the south-central area, where leachate discharged to the underlying Upper Gravel Aquifer.

Since construction of the engineered cap and storm water diversion systems, between 75 and 90 percent of the water that entered the landfill has been diverted and leachate levels have dropped by as much as 20 feet. This can be seen by comparing water elevations within the landfill in Figures 5-1 and 5-5, which corresponds to a 90 percent reduction in the amount of saturated refuse. The only remaining sources of water to the landfill are the shallow, discontinuous zones of groundwater north and south of the landfill. Water within the landfill now slowly evaporates into the gas system or leaks through the base of the landfill, approximately 100 to 150 feet below ground surface, into the underlying Upper Gravel Aquifer, described below.

5.4.2.2. Landfill Leachate Water Quality

Studies conducted during the RI established that most of the leachate from the landfill was aqueous. A small amount of floating light non-aqueous phase liquid (LNAPL) was also detected in the landfill. Dense non-aqueous phase liquid (DNAPL) has never been detected at the landfill. Leachate samples were collected as part of the RI and analyzed for conventional water quality parameters and compounds on the EPA hazardous substance list. Results from these analyses and related monitoring indicated:

- The aqueous leachate contained aromatic and aliphatic hydrocarbons, dissolved salts, suspended particulates and low levels of VOCs and metals. Polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) were only detected in groundwater samples in wells located adjacent to or in direct contact with NAPL pools.
- The LNAPL contained metals, VOCs including trans-1,2-dichloroethene and the BETX group (benzene, ethylbenzene, toluene and xylene), PAHs commonly detected in petroleum oil, and PCBs. PCB concentrations ranged from 107 ppm to 1,142 ppm.
- Some wells within the landfill had up to 20 feet of NAPL. Monitoring of wells outside the landfill did not detect any NAPL.
- A pumping program was tested as part of the 1990 FS to see if the LNAPL was extractable. Less than 100 gallons were extracted from the three wells with the greatest volume of

NAPL; recharge into these wells was very slow.

Water quality in the landfill leachate has not been monitored as part of the performance monitoring system, though water depth and LNAPL have been. By 1998, of the approximately 18 wells monitored for oil thickness, approximately 13 had either no oil or only a trace of oil. The remaining 5 had oil measured between 0.27 feet and 3.96 feet.

5.4.3 The Upper Gravel Aquifer (UGA) and the Upper Silt Aquitard

5.4.3.1. Hydrogeology of the UGA and Upper Silt Aquitard

The Upper Gravel Aquifer consists of fifty to one hundred feet of outwash gravels that underlie the low permeability layer at the base of the landfill located 100 to 170 feet below ground surface. These gravels consist of interbedded zones of permeable gravels and less permeable mixtures of silt, sand, and gravels. Prior to construction of the actions required by the 1990 consent decree, discharge from the landfill resulted in significant areas of saturation within the UGA, especially in water-bearing strata at the base of the unit, where several monitoring wells were placed. (See, for example, Figure 5-5.)

Groundwater flow in the UGA is generally from both the north and south inward toward an area beneath the southern end of the landfill where the groundwater discharges downward into the underlying Sand Aquifer (SA). The UGA and SA are separated by the Upper Silt Aquitard, a discontinuous layer of fine-grained silt, clayey silt, and silty fine sand that is present throughout most of the study area. Vertical flow from the UGA into the SA is most pronounced in places where the aquitard is absent. One of these “windows” in the aquitard exists beneath the southern end of the landfill, where it allows the discharge from the UGA into the SA to occur. Discharge through this window was manifested as a distinct groundwater sink during the RI.

The construction of the remedial actions required by the 1990 consent decree and the subsequent dewatering of the refuse have greatly reduced the amount of recharge entering this unit. Groundwater continues to enter the UGA north and south of the landfill, and the groundwater and leachate continues to flow toward the sink beneath the southern part of the landfill.

However, the response of the UGA to changing conditions at the landfill was strong and rapid as indicated by the monitoring wells designed to monitor water quality conditions. Within the landfill footprint and around the perimeter, the UGA monitoring wells have been dry since 1992, even with rainfall that was significantly greater than average during the years from 1997 to 1999. Figure 5-6 shows the current potentiometric surface of the UGA. The sink still exists and appears to have "deepened" due to the loss of recharge from the landfill.

The UGA beneath the landfill is under vacuum from the landfill gas collection system. Any leachate leaking through the base of the landfill and infiltrating into this zone moves mostly by unsaturated flow and is directly exposed to the vacuum under conditions designed to strip volatile organics from the infiltrating water. This combination of predominately unsaturated conditions in the aquifer and the vacuum from the gas extraction system helps to contain volatile organics from being released to the underlying groundwater system.

5.4.3.2. Water Quality in the Upper Gravel Aquifer (UGA)

Prior to construction of the actions required by the 1990 consent decree, water quality in the water-bearing strata at the base of the unit, where several monitoring wells were placed, showed significant impacts from leachate. However, the RI concluded it was unlikely that contamination in the Upper Gravel Aquifer existed further than 100 to 200 feet from the landfill (in the south, west, and east direction) because of the strong component of downward flow in the aquifer into the underlying Sand Aquifer.

Following the remedial work required by the 1990 consent decree, the monitoring network in the UGA included two up gradient wells (MW-21A and MW-16) and two downgradient wells (MW-7A and MW-19B). The downgradient wells were located at points where the saturated refuse was believed to be discharging leachate downward into the UGA. However, the downgradient wells MW-7A and MW-19B have not been sampled since 1992 due to the declining groundwater levels in the UGA. In the two or so years prior to going dry, both wells had no detectable concentrations of any VOCs, except chlorobenzene at concentrations ranging from non-detected to 4 ppb (the federal drinking water standard or Maximum Contaminant Level (MCL) is 100 ppb); benzene at concentrations ranging from non-detect to 3 ppb (MCL is 5 ppb); chloroethane at concentrations from non-detected to 3 ppb and single hits of 1,2-dichloroethane at 1 ppb and acetone at 25 ppb. During the same years, manganese concentrations ranged from 3.5 to 5.2 mg/L.

5.4.4 The Sand Aquifer (SA) and the Lower Silt Aquitard

5.4.4.1. Hydrogeology of the Sand Aquifer and the Lower Silt Aquitard

The SA occurs as a widespread regional deposit of interbedded sands and silts 200 to 300 feet below the surface. Flow in this aquifer in the vicinity of the landfill is generally from the north and west to the southeast toward a hydraulic sink that occurs across a broad area beneath the southern part of the landfill and extending several hundred feet to the east (Figure 5-7). Groundwater to the south and east of this sink also flows towards the sink. Consequently, the sink limits the extent that the landfill impacts the SA, and impacts are not seen beyond the sink to the east. This sink is believed to be located from the southeastern section of the landfill and up to 800 feet further east. Groundwater entering this sink flows downward into the Southern Gravel Aquifer (SGA).

The deepening of the sink in the UGA as the landfill dewatered is also seen in the SA where the SA sink has also deepened over the last 5 years. The two SA groundwater flow monitoring wells within the footprint of the landfill are currently dry, and have been for several years; the down gradient SA groundwater chemistry monitoring wells, which are located further from the landfill, only sometimes contain sufficient water for sampling.

The SA and SGA are separated by the Lower Silt Aquitard. Like the Upper Silt Aquitard, the Lower Silt Aquitard is present as a significant unit throughout the site, but is discontinuous in places. These “windows” in the aquitard allow for the downward flow from the SA into the SGA. The largest such window identified in the study area exists below the sink in the SA.

5.4.4.2. Water Quality in the Sand Aquifer

The post-1990 monitoring network in the SA initially included four up gradient wells (MW-8B, MW-30B, MW-17B, and MW-21B) and three down gradient wells (MW-15A, MW-20A, and MW-23A). MW-30B was originally installed as a down gradient well, but the potentiometric surface showed that it was actually up gradient of the landfill on the far side of the groundwater sink formed by SA groundwater discharging into the SGA. The well has consistently been clean, and has been deleted from the groundwater monitoring network.

In this aquifer, the groundwater quality situation is complex because of up gradient contamination flowing towards the landfill. The up gradient wells MW-17B and MW-21B are contaminated with chlorinated solvents, as shown below:

Up Gradient Monitoring Wells In the Sand Aquifer - Recent Concentrations

MW-17B	Recent concentrations	MCL
1,1-dichloroethane	90 to 160 ppb	800 ppb*
1,1-dichloroethene	4.8 to 8.2 ppb	7 ppb

1,2-dichloroethane	8 to 12 ppb	5 ppb
MW-21B		
1,1-dichloroethane	11 to 14 ppb	800 ppb*
1,1-dichloroethene	1.6 to 2.6 ppb	7 ppb
tetrachloroethene	24 to 35 ppb	5 ppb
trichloroethene	2.4 to 3.1 ppb	5 ppb

* 1,1-dichloroethane has no MCL. 800 ppb is the MTCA Method B cleanup level in the 2/96 CLARC II table.

Contamination in MW-17B has remained fairly constant over the last decade, while contamination at MW-21B has been increasing slightly over the last several years. These two wells remain the most contaminated wells in the monitoring well network, in terms of number of contaminants found in the groundwater. Both Ecology and the City of Seattle have conducted studies to identify possible sources of this up gradient contamination.

MW-15A and MW-23A were selected to provide water quality information in the hydraulic sink area. MW-23A has not been sampled since 1993 due to declining groundwater levels in the Sand Aquifer. MW-15A was not sampled between 1993 and 1997, but has had sufficient water for sampling from 1997 to the present. Since 1997 all VOCs have been non-detected except 1,2-dichloroethane with concentrations from 1.1 to 2.1 ppb and manganese concentrations have ranged from 0.005 to 0.028 mg/L. In the two or so years prior to water levels getting low, MW-23A had similarly low concentrations of VOCs with 1,1-dichloroethene from non-detected to 2 ppb; 1,2-dichloroethane from 1.9 to 4 ppb; and trichloroethene from non-detected to 2 ppb. Manganese concentrations ranged from 1.7 to 4.1 mg/L.

One additional sand aquifer monitoring well (MW-20A) is located just west of the landfill. This well is hydraulically down gradient of the up gradient source area near MW-17. Monitoring well MW-20A is also located hydraulically up gradient of the western edge of the landfill because water from the Sand Aquifer flows underneath the landfill and down into the Upper Gravel Aquifer. Historically, the water quality in the zone monitored by MW-20A was impacted by both landfill and up gradient sources. MW-20A has been dry and thus not sampled since 1994. In the two or so years before going dry, the following concentrations were found in MW-20A:

MW-20A - 1992 to 1994 Concentrations

	1992 to 1994 Concentrations	MCLs
1,1,1-trichloroethane	non-detected to 2.4 ppb	200 ppb
1,1-dichloroethane	12 to 37 ppb	800 ppb*
1,2-dichloroethane	2 to 5.3 ppb	5 ppb
1,2-dichloroethene	non-detected to 2 ppb	70 ppb
benzene	non-detected to 1.1 ppb	5 ppb
chloroethane	15 to 20 ppb	***
manganese	0.735 to 1.28 mg/L.	2.2 mg/L**

* 1,1-dichloroethane has no MCL. 800 ppb is the MTCA Method B cleanup level in the 2/96 CLARC II table.
** manganese has no primary MCL. 2.2 mg/L is the MTCA Method B cleanup level in the 2/96 CLARC II table.
*** chloroethane, also known as ethyl chloride, has no MCL nor MTCA Method B cleanup level in the 2/96 CLARC II table.

5.4.5. The Southern and Northern Gravel Aquifers

5.4.5.1. Hydrogeology of the Southern and Northern Gravel Aquifers

The deepest stratigraphic units studied were the Northern and Southern Gravel Aquifers (NGA and SGA, respectively); they occur at about the same elevation (300 to 350 feet below the surface), but hydraulic heads in the NGA are typically 100 feet higher than heads in the SGA. During the RI, the NGA was found to be clean and unimpacted.

The SGA is found beneath the southern half of the landfill and extends to the east, south and west. It consists of permeable sands and gravel interbedded with silts and silty gravel. The SGA appears to be recharged by the SA and by lateral flow from the south. A groundwater mound in the SGA, below the hydraulic sink in the SA, is believed to be an expression of regional flow through the sink. Groundwater flow from the mound is to the east and west; flow to the north is blocked by higher potentiometric heads within the NGA. Groundwater in the SGA eventually discharges west to Puget Sound and east to the Green River Valley. The 1998 potentiometric surface of the SGA is shown in Figure 5-8. Although the groundwater mound is still present, water levels along the historical high point (MW-14B, for example) have dropped by as much as 10 feet from pre-remedial conditions.

Responses to changing recharge conditions have been fairly rapid between the base of the landfill and the SGA, with decreases in the SGA water levels occurring in less than 5 years from completion of the remedy required by the 1990 consent decree. Once groundwater enters the SGA, the primary direction of flow shifts from vertically downward to horizontal, with much lower potentiometric heads driving the flow indicating that water movement within the SGA horizontally away from the landfill will be much slower than vertical movement into the SGA.

5.4.5.2. Water Quality in the Southern Gravel Aquifer

Currently, the Southern Gravel Aquifer is the primary aquifer in which groundwater moves out and away from the landfill, and thus is the primary potential groundwater exposure pathway beyond the landfill property.

The post-1990 monitoring network in the SGA initially consisted of one up gradient well (MW-24B) and five downgradient wells (MW-14B, MW-20B, MW-23B, MW-29B, and MW-30C). Well 24B has since been removed from the water quality monitoring network because it has never shown any evidence of groundwater contamination.

Monitoring wells MW-14B, MW-23B, and MW- 29B form a line of monitoring wells to the east of the landfill, with MW-14B located at the edge of the landfill, and the other two wells approximately 600 and 1,500 feet further east, respectively.

The monitoring results for MW-14-B are interesting. (Table 5-1.) While the average 1,2-dichloroethane concentration during the RI was 50 ug/L, and were generally in the 10 to 20 ug/L range in the early 1990's, the 1,2-dichloroethane concentration has been non-detectable (with a detection limit of 1 ug/L) in this well in the four sampling rounds between May 1998 and November 1999. Similarly, while the average vinyl chloride concentration during the RI was 4 ug/L, and the concentrations were generally in the 2 to 4 ug/L range in the early 1990's, vinyl chloride concentration has been non-detected (with a detection limit of 1 or 2 ug/L) in this well in these four recent sampling rounds. Cis-1,2-dichloroethene is also found in the 5 to 7.7 ug/L range (the MCL is 70 ug/L) as has been 1,1-dichloroethane in the 1.6 to 3 ug/L range (no MCL, but the MTCA Method B cleanup level is 800 ug/L.) No other monitored VOCs have been detected in the past two years. Concentrations of chloride (a leachate marker) and manganese (from 4.8 mg/L average in the RI to approximately 1.5 mg/L in 1999) have shown similar reductions. Since MW-14B is located where SA groundwater discharges into the SGA, and the SA has been in compliance since 1994, this change is interpreted as the beginning of a “clean front” moving into the SGA.

Concentrations in MW-23B (Table 5-2) have also been declining, but at a slower rate. For example, average RI concentrations of 1,2, dichloroethane and vinyl chloride were 13 ug/L and 5 ug/L respectively; concentrations of these chemicals have been around 7 ug/L and 2 ug/L, respectively, in the four sampling rounds since May 1998. Manganese concentrations have always been low in this well, generally around 0.3 mg/L. Cis-1,2-dichloroethane is also detected in this well in the 4.5 to 6.4 ug/L range.

Concentrations are remaining constant in MW-29B. For example, over the past three years, 1,2-dichloroethane has consistently been detected in the 5 to 10 ppb range (as compared to the RI average concentration of 5 ppb) with 1,1-dichloroethane detected a single time at 1.2 ppb and vinyl chloride detected a single time at 1.1 ppb. Manganese concentrations are low and have ranged from 1.06 to 1.24 mg/L over the past four years.

The volatile COCs historically have rarely been detected in downgradient wells MW-20B (to the west of the landfill) or MW-30C (to the far southeast of the landfill).

Background manganese concentrations are high in the SGA and the related Northern Gravel Aquifer, with the regional background concentration considered to be 1.1 mg/L. MW-24B, MW-23B, MW-29B, and MW-30C all have manganese concentrations at or below background; and manganese concentrations in MW-14B have been decreasing rapidly over the last few years as a “clean front” of less contaminated groundwater enters the SGA. However, manganese concentrations in MW-20B are above background and increasing, with concentrations in the 4.5 to 5.87 mg/L range over the past 3 years, as compared to an average of 1.84 mg/L during the RI. Since this well also has elevated levels of chloride, which is a marker of landfill leachate, the cause is likely an indirect result of Midway Landfill leachate. Manganese is a natural mineral that likely is dissolving into the groundwater because of the chemistry of the landfill leachate.

In summary, two volatile COCs are detected above MCLs to the east of the landfill in MW-23B and MW-29B, but have not been detected in recent rounds in MW-14B near the landfill boundary. Manganese concentrations exceed background in MW-14B and MW-20B, but are decreasing rapidly toward background in MW-14B.

5.5. Nature and Extent of Gas Migration

The Upper Gravel Aquifer beneath the landfill is under vacuum from the landfill gas collection system. The vacuum extends to the Sand Aquifer is some locations. Sixty-three gas probes throughout the neighborhood are regularly monitored for landfill gas. Figure 5-9 shows the extent of the vacuum system beneath the landfill. As of 1997, none of the off-landfill property gas extraction wells were still in use because of the significant decreases in off-property methane gas concentrations. All gas probes and gas monitoring locations surrounding the landfill are under the state's landfill gas regulatory limits and all such monitoring locations where the limit may be approached are under the influence of the gas collection system. During the RI, numerous hazardous substances were found in the extracted landfill gas including vinyl chloride, xylenes, toluene, benzene and other solvents.

5.6 Surface Water, Seeps and Soil Contamination

Surface water, seeps and soils in areas around the landfill were sampled in the late 1980's as part of the RI and no contamination from the Midway Landfill was found.

6. Current and Potential Future Land and Resource Uses

Land Use: Currently, the landfill is capped and fenced. No public access is allowed. Future land use has been the subject of an extensive but preliminary 1992 study by community representatives, the City of Kent, and the City of Seattle. Some possible uses considered desirable by the Midway Citizens Advisory Committee include open space uses such as a passive park, a sports complex with ball fields, or garden center. Less desirable but potentially possible future uses would be a golf driving range or a park and ride facility. All uses would be designed to protect the integrity of the cap and other containment systems.

Groundwater uses: To the best of Ecology's and the City's knowledge, no one is drinking the groundwater from any aquifer within almost a mile of the landfill, and there are no current plans to use the groundwater near the landfill for drinking water. The closest wells currently in use for drinking water are the Lake Fenwick wells almost 1 mile southeast of the Midway Landfill.

As part of the Midway Landfill Environmental Impact Survey (EIS) in 1985, the City's contractor located private wells within a one-mile radius of the landfill, and public wells within five miles of the landfill by reviewing numerous agency files. Based on this inventory, the contractor sent questionnaires to approximately 90 households near the landfill in order to verify the existence and use of private wells. The list of households was updated during the RI, and several key downgradient wells were re-verified in 1999. Citizens were also questioned at several public meetings and at meetings of the Midway Action Group regarding their knowledge of any wells in neighborhoods surrounding the landfill.

From this information, 31 private wells were identified within a one-mile radius of the landfill.

(See Figure 6-1.) Of the 31 wells, nine are in use, 12 are unused, and 10 are inoperable. Of the nine wells, five are used for drinking water, including the Lake Fenwick supply, which services nine homes, and the other four wells are used for irrigation. The five drinking-water wells are all located over 4,600 feet from the landfill, in the Lake Fenwick area. Three of the four irrigation wells are located over 2,000 feet southwest of the landfill (out of the plume path). The fourth irrigation well is located between the groundwater plume and the Lake Fenwick wells.

Monitoring Well MW-30 in the Southern Gravel Aquifer was added in 1988 to act as an early warning location should any measurable contamination from the landfill move toward the irrigation well or toward the Lake Fenwick wells. MW-30 is still monitored, and has generally remained clean and unimpacted throughout the groundwater monitoring program.

Two other wells were identified within 1,000 feet of the landfill (Well Nos. 37 and 57). Well No. 57 is dry and owned by the City of Kent. Well No. 37, on privately owned property, is unused and covered.

There are three public wells in the Midway Landfill area. Two are operated by the Highline Water District near the two intersections of South 209th Street and 31st Avenue South, and South 208th Street and 12th Avenue South, respectively. These two wells are screened in the second confined aquifer, at over 120 feet below sea level. Both are over two miles north and northwest from the landfill in an area that is up gradient of the landfill, and are completed in aquifers that are not connected to the affected aquifers. The third well is operated by the Kent Water District at South 212th Street and Valley Freeway and is used to satisfy peak summer demands. None of these municipal wells draw water from affected aquifers, and all are more distant from the landfill than are the Lake Fenwick wells.

Finally, neither water district has future plans to develop groundwater supplies from any aquifers within a one-mile radius of the Midway Landfill. The wellhead protection areas delineated by these utilities do not include the Midway Landfill site.

State regulations (WAC 173-160 -171) do not allow any new private drinking water wells within 1000 feet of a solid waste landfill or 100 feet of all other sources or potential sources of contamination, and notice is required to be given to Ecology prior to the construction of any well. However, the NCP is more stringent and requires EPA to consider all groundwater as drinking water except directly under a waste management area. The landfill area with refuse is a waste management area and thus is not considered a future drinking water source by EPA. All other areas downgradient of the landfill are considered to be potential future drinking water sources. However, it is likely that all future developments lie within water district service areas and, therefore, are not likely to rely on private wells for their potable water supply.

7. Summary of Site Risks

7.1 Human Health Risks - Prior to the Work Required by the 1990 Consent Decree.

Before the cleanup work began at the Midway Landfill site in 1985, there were many ways in which humans could have potentially been exposed to unacceptable levels of contaminants. These exposures could have posed acute hazards to residents due to the high levels of methane gas reaching residential basements, and long-term potential risks from solvents in the groundwater if anyone had been drinking the groundwater. The risks from these possible exposures were greater than EPA's and the State of Washington's acceptable risk levels. For example, if a person had been using the groundwater in MW-14B, one of the most contaminated down gradient wells, as their source of domestic water for 30 years, the estimated excess cancer risk from vinyl chloride and 1,2-dichloroethane alone would have been approximately 6 x 10-4. Other possible exposures could have occurred through air emissions or through direct contact with the landfill contents.

The City's contractors prepared an Endangerment Assessment (EA) as part of the 1990 RI/FS for Midway Landfill. Because the RI found little contamination in the surface water, seeps or soil, the EA concluded that the contaminants detected in these environmental media had not migrated from the landfill. The EA also found that there was no direct exposure pathway connecting leachate to either human or ecological receptors. The only potential exposure pathways existed through cross-media pathways: volatilization of contaminants from leachate into landfill gas or discharge of leachate into the groundwater system. The contaminants in landfill gas were found to pose a negligible risk leaving leachate to groundwater as the only migration pathway of concern.

7.2 Current and Future Human Health Risks

A baseline risk assessment that follows current EPA Superfund guidance on risk assessment and that reflects current conditions at the landfill has not been performed on Midway Landfill because the contaminants of concern, migration routes, and the risks to human health and the environment were characterized in 1990 EA. Based on the success of the containment actions required by the 1990 consent decree, there are likely to be no current unacceptable risks to human health from the landfill because the gas migration has been stopped and no one is currently drinking the groundwater. VOC contamination in the groundwater downgradient of the landfill also appears to be decreasing, at least in the well closest to the landfill. The only remaining contaminants of concern appear to be vinyl chloride, 1,2-dichloroethane, and manganese.

Even though no baseline risk assessment has been done, the potential future risk was estimated. Vinyl chloride is a known human carcinogen and 1,2-dichloroethane is a probable human carcinogen. Manganese is an essential nutrient but is toxic in high quantities. The estimated risk was calculated considering only the maximum 1999 concentrations in Well MW-23B, currently the monitoring well with the highest concentrations of VOCs downgradient of the landfill. This estimate was calculated assuming domestic use of the groundwater for drinking and showering, EPA's reasonable maximum exposure assumptions for 30 years, IRIS or Region 9 PRG table toxicity values, and a conservative assumption that the contaminant concentrations will not change in the future. The excess cancer risk is estimated to be approximately 1 x 10-4 (with vinyl chloride being the primary risk driver) and the HI is estimated to be approximately .3 (with manganese being the primary risk driver), both of which are within EPA's acceptable risk range. This cancer risk level is, however, not within the acceptable risk level under Washington's Model Toxics Control Act, which requires that cumulative excess cancer risk be no greater than 1 x 10-5.

The estimated risk was also calculated for MW-20B, again considering only the maximum 1999 concentrations and using the same assumptions. Well MW-20B is currently the monitoring well with the highest concentration of manganese downgradient of the landfill. The Hazard Quotient for manganese in this well is approximately 6.

These estimated risks are potential future risks only, because there are no drinking water wells within the down gradient plume of the landfill, nor are there any plans to place any drinking wells in this area in the future. (See Section 6.)

7.3 Ecological Risks

No ecological risks to plants or animals are expected now or in the future because there will be no exposure to the contaminants at or from the site. The site is covered and capped with clean material, and the groundwater from the site does not impact any surface water bodies or seeps. Surface water discharging from the site is monitored for conventional pollutants such as pH, dissolved oxygen and turbidity. No hazardous substances are expected to be in the surface water discharge from the landfill because the remedial actions under the 1990 consent decree have eliminated surface water contact with the refuse..

7.4. Basis for Action

While the estimated future risk from drinking groundwater downgradient from Midway Landfill is within the NCP acceptable risk range, there is groundwater contamination above federal drinking water standards, or MCLs, in two monitoring wells east of the landfill and I-5. According to EPA policy, when MCLs are exceeded, action is generally warranted. In addition, state groundwater cleanup levels under MTCA are exceeded. Because drinking this groundwater could result in an imminent and substantial endangerment to human health, remedial action is needed at Midway Landfill.

8. Remedial Action Objectives

Midway Landfill is an example of a site where containment has been successful and has reduced the risks posed by the site. However, the containment measures already in place must be maintained and institutional controls are necessary to ensure continued long-term protection of human health and the environment.

The remedial action objectives of this response action are:

- To ensure containment is effective and working
- To ensure containment will be maintained
- To return groundwater to drinking water standards and state cleanup standards downgradient of the landfill boundary
- To ensure no residential exposure to groundwater until groundwater cleanup standards have been met

Cleanup Standards

For groundwater that is a potential future source of drinking water, the more stringent of federal drinking water standards (also known as Maximum Contaminant Levels or MCLs) and State of Washington cleanup standards under the Model Toxics Control Act (MTCA) are the cleanup levels. For the groundwater contaminants at this site, the cleanup levels and their basis are shown in Table 1.

Table 8-1. Groundwater Cleanup Standards

Contaminant	Cleanup Level	Basis of the Cleanup Level
1,2-dichloroethane	5 ug/L	Federal Drinking Water Standard (MCL)

vinyl chloride	.02 ug/L*	MTCA Method B.
manganese	2.2 mg/L	MTCA Method B

* Pursuant to WAC 173-340-707(2), Ecology will utilize the practical quantitation limit (PQL) of 0.2 ug/L to determine compliance with this cleanup standard because the cleanup standard is lower than the PQL.

1,2-Dichloroethane and vinyl chloride are solvents. Vinyl chloride can also be formed in groundwater during the natural breakdown of other solvents. Manganese is a natural mineral in soil that dissolves into the groundwater because of the chemistry of the water leaving the landfill.

If other contaminants resulting from releases from the landfill are found in any downgradient monitoring well, cleanup levels will be established for these additional contaminants using the federal drinking water standards and MTCA.

The point of compliance for the groundwater will be at the edge of the landfill waste as specified in a Compliance Monitoring Plan to be approved by Ecology. Under MTCA, this location is considered a "conditional point of compliance." All groundwater downgradient of this point of compliance will need to meet these cleanup levels for contaminants resulting from releases from the landfill before the Midway Landfill is removed from the Superfund National Priorities List.

9. Summary of Remedial Alternatives

Two remedial alternatives were considered for the Midway Landfill site.

No Action Alternative:

Under the No Action alternative, EPA would not require any additional action at the Midway Landfill site. The City of Seattle would still have to fulfill its responsibilities under its 1990 consent decree with Ecology, as well as any other requirements established under state or local regulations for closed landfills. Monitoring could be required under this alternative. EPA would not set cleanup levels nor points of compliance under this alternative.

Limited Action Alternative:

This alternative does not require any significant additional remedial construction because the actions taken by the City of Seattle since 1985 have eliminated or greatly reduced the contaminants leaving the landfill. Instead, this alternative focuses on maintaining and monitoring the constructed containment remedy to ensure it is and will continue to be effective and protective. This alternative would also set groundwater cleanup levels and points of compliance. This approach is consistent with EPA's presumptive remedy for municipal landfills.

The main elements of the limited action alternative are:

1. Monitor to :

   a) ensure the remedial systems are working as designed,

   b) ensure progress is being made towards meeting the groundwater cleanup standards,

   c) ensure adequate containment is maintained when and if major changes are approved by Ecology in the operation of the site, such as turning off or scaling down the gas collection system, and

   d) demonstrate that the cleanup levels have been achieved.

2. Continue to operate and maintain all remedial elements required in the 1990 Ecology/City of Seattle consent decree.

3. Institutional controls. Institutional controls are legal or administrative actions that help ensure the long-term protectiveness of the remedy. At this site, the limited action alternative includes three types of institutional controls. The first type of institutional control would be a legal notice the City would place in King County's records, alerting any future purchaser of the property, in perpetuity, that this property had been used as a landfill and was on EPA's National Priorities List, and that future use of the property is restricted. The second type of institutional control is a requirement that the City ensures continued operation and maintenance of the containment and monitoring systems if ownership of the property should change. Both of these institutional controls are required as part of the 1990 consent decree between Ecology and the City of Seattle, though the legal notice has not yet been placed in the County's records. The third type of institutional control is an annual written notice about the groundwater quality down gradient from the landfill. The City of Seattle would be required to notify the Seattle-King County Department of Public Health, nearby water districts, locally active licensed well drillers and Ecology. As an additional protection, state regulations forbid any private drinking water wells within 1,000 feet of a municipal landfill or within 100 feet from all other sources of potential contamination.

The remedy would also be reviewed no less often than every five years to ensure that the remedial action remains protective of human health and the environment.

10. Comparative Evaluation of Alternatives

EPA evaluated the two alternatives using the nine criteria established in EPA's National Oil and Hazardous Substances Pollution Contingency Plan. The nine criteria are divided into three categories: threshold, balancing, and modifying criteria. To be eligible for selection, an alternative must meet the first two threshold criteria. The next five criteria are the balancing criteria which weigh trade-offs among the alternatives. The last two modifying criteria are considered after the public comment period during the final selection of the remedy.

Overall Protection of Human Health and the Environment
Both alternatives are protective, because the City of Seattle would continue to operate and maintain the cap, and the gas and storm water systems under both alternatives.

Compliance with Applicable or Relevant and Appropriate Requirements
Federal and state drinking water standards and MTCA groundwater cleanup standards are the primary applicable or relevant and appropriate requirements under the Limited Action Alternative. The cleanup standards listed above would need to be met in the downgradient monitoring wells before the remedial action at the Midway Landfill could be considered complete. No cleanup standards would be set by EPA under the No Action Alternative, though Ecology could decide to set cleanup standards separately under MTCA at a later time.

Long-term Effectiveness and Permanence
The Limited Action Alternative has greater long-term effectiveness and permanence than the No Action Alternative because it would require annual notice to water districts and well permit regulators, which would provide slightly greater assurance that no one would drink the groundwater leaving the landfill. It would also clarify the need to adjust monitoring requirements as site conditions change.

Reduction of Toxicity, Mobility and Volume of Contaminants through Treatment
Neither alternative includes any additional treatment. Extracted landfill gas is flared as part of the existing landfill gas collection system.

Short-term Effectiveness
Both alternatives have the same short-term effectiveness. Neither alternative includes construction nor will either alternative affect the time needed for all groundwater leaving the site

to meet cleanup standards.

Implementability
Both alternatives are equally implementable.

Cost
The costs for the two alternatives are expected to be very similar. The monitoring costs for the Limited Action Alternative may be slightly higher than the monitoring costs for the No Action Alternative.

State Acceptance
Ecology was consulted on the proposed plan and reviewed this ROD. Ecology concurs with the selected limited action remedy.

Community Acceptance

Four comment letters have been received. Two letters, from the Seattle-King County Department of Public Health and from a local resident, supported the Limited Action Alternative. The second letter, from the City of Des Moines, does not express any opinion about the alternatives, but is concerned about turbidity that may be leaving the landfill cap and discharging into North McSorley Creek. The City of Des Moines asked the City of Kent and the City of Seattle to prepare a storm water pollution plan for turbidity from this outfall, and asked for specific monitoring. The City of Seattle supported the Limited Action Alternative, but requested certain changes and clarifications. A longer summary of these comments and EPA's responses can be found in the attached Responsiveness Summary.

EPA staff also received informal comments through phone calls. In these calls, five members of the public supported the limited action alternative.

11. The Selected Remedy

11.1 Summary of the Rationale for the Selected Remedy

EPA's selected remedy is the Limited Action Alternative. Of the alternatives considered, this alternative will provide the best long-term protectiveness at the Midway Landfill site. It sets groundwater cleanup standards and it ensures long-term operation, maintenance, and monitoring of the containment systems at the Midway Landfill site. It would also clarify the need for, and types of, institutional controls that are necessary to ensure long-term protectiveness of the remedy.

Additionally, this alternative will best ensure long-term protectiveness of the containment remedy currently in place. While EPA believes no new remedial construction (as EPA guidance defines the term) is needed, it is important that the City of Seattle continue to operate and maintain the gas collection system, the cap that was constructed over the landfill, and the storm water collection system. The City also needs to continue to monitor the effectiveness of these systems and cap, and to regularly sample the groundwater until groundwater cleanup standards have been met. The City needs to establish permanent, legally binding, controls on the landfill property to ensure that the cap and containment systems are not damaged as long as the cap and gas and storm water systems are required. The less formal institutional control requirements, in the form of notices to agencies, water districts, and active well drillers, for the off-property groundwater contamination are appropriate for this site considering that the area is fully served by community water systems, no private wells are known to be in use, and the relatively low levels of remaining contamination in the downgradient monitoring wells. Also, groundwater cleanup levels for the groundwater downgradient of the landfill need to be established.

In order for Ecology to utilize this ROD as a Cleanup Action Plan, the cleanup action established through the ROD must meet the MTCA remedy selection requirements of WAC 173-340-360(2) (threshold requirements) and (3) (requirement to utilize permanent solutions to the maximum extent practicable; requirement to provide for a reasonable restoration time frame; requirement to consider concerns raised during public comment.) WAC 173-340-360(13). The threshold requirements for remedy selection are that the remedy shall protect human health and the environment, comply with cleanup standards, comply with applicable state and federal laws, and provide for compliance monitoring. Ecology has determined that the selected remedy, as described in the ROD, satisfies those threshold requirements.

With respect to MTCA's preference for permanent solutions, Ecology has determined that the following remedies for individual components, taken together, are permanent to the maximum extent practicable in that they prevent or minimize the migration of hazardous substances into the environment and provide for a net reduction in the amount of hazardous substances released from the source area. First, with respect to the Midway Landfill refuse itself, Ecology has determined that the isolation and containment remedy of the 1990 consent decree and this ROD is the preferred available cleanup technology. See WAC 173-340-360(9)(c) (describing Ecology's expectations of sites with large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable.) With respect to landfill gas generated by the refuse, Ecology has determined that the treatment of such gas, as specified under the 1990 consent decree and this ROD, constitutes "destruction or detoxification" which is the highest preference cleanup technology under MTCA. With respect to groundwater contaminated by landfill leachate, Ecology has determined that the incremental benefit to be realized from implementing additional remedial engineering measures (e.g. treatment) is substantially and disproportionately outweighed by the cost of such measures. This determination is based upon the facts that: 1) the actions taken by the City of Seattle since 1985 have eliminated or greatly reduced the contaminants leaving the landfill; 2) the levels of contamination that remain in the groundwater are low and trending towards compliance with cleanup standards; and 3) the groundwater does not have any current human or environmental receptors. Therefore, Ecology has determined that institutional controls and monitoring, as required under this ROD, constitute an appropriate remedy for groundwater until cleanup levels are achieved.

With respect to a reasonable restoration time frame, EPA and Ecology agree that the remedial actions implemented have created conditions under which groundwater will achieve compliance with the cleanup standards over time. Based on the results of the groundwater monitoring to date, it is apparent that groundwater down gradient of the landfill is very near compliance with the cleanup standards. Ecology concludes that based on present trends, it is likely that groundwater down gradient of the landfill will reach compliance with cleanup standards in approximately five years. Based upon the facts that institutional controls aimed at preventing the use of contaminated groundwater as a drinking water source are a component of this ROD, that the contaminant levels are already low; and that a documented trend towards compliance exists. Ecology has concluded that this constitutes a reasonable restoration time frame.

Finally, Ecology has determined that the ROD has considered concerns raised during public comment. (See ROD Section 13 and EPA Responsiveness Summary.)

11.2. Detailed Description of the Selected Remedy

The selected remedy consists of:

1. Monitor to :
   a) ensure the remedial systems are working as designed,
   b) ensure progress is being made towards meeting the groundwater cleanup standards,
   c) ensure adequate containment is maintained when and if major changes are approved by Ecology in the operation of the site, such as turning off or scaling down the gas collection system, and
   d) demonstrate that the cleanup levels have been achieved.

The monitoring will be done by the City of Seattle, while Ecology will continue to be the lead cleanup regulatory agency at the site. The details of the monitoring requirements have been set out by the City of Seattle in an Ecology-approved compliance monitoring plan.

Monitoring, including installation of new monitoring wells, are among the activities EPA expects at sites even after EPA determines that construction has been "completed" at a site. Through the procedures outlined in the agreements between Ecology and the City of Seattle, Ecology may require the City of Seattle to install and monitor new monitoring wells if needed.

If necessary, the monitoring program may also address the issue of the source of turbidity in North McSorley Creek raised by the City of Des Moines in their comment letter on the proposed plan. The City of Des Moines requested that the City of Seattle continue to monitor the S. 250th Street outfall for turbidity during storm events (on a periodic basis) and provide the results to the City of Des Moines Engineering Department.

2. Continue to operate and maintain all remedial elements required in the 1990 consent decree. Ecology will continue to oversee the City's operation and maintenance activities. Operational changes can be approved by Ecology when such changes ensure that the site and remedy will remain protective. The Seattle King County Public Health Department should be given the opportunity to review requested operational changes.

3. Institutional controls. Institutional controls are legal or administrative actions that help ensure the long-term protectiveness of the remedy. At this site, the selected remedy consists of three types of institutional controls. Variations of the first two types of institutional controls are already required in the 1990 consent decree.

A. The City of Seattle will place a notice in the records of real property kept by the King County auditor, alerting any future purchaser of the landfill property, in perpetuity, that this property had been used as a landfill and was on EPA's National Priorities List, and that future use of the property is restricted. The use restriction shall comply with the post-closure use restrictions under the State of Washington's Criteria for Municipal Solid Waste Landfills (WAC 173-351-500(1)(I) and (2)(c)(iii). The City has not yet placed any legal notice in the County's records even though a form of this notice was required by the 1990 consent decree. EPA understands that this is a subject that will be addressed through an amendment to the 1990 consent decree. EPA expects the City to place this notice on the deed within six months of the date of effective date of the consent decree amendment, unless the City has negotiated an alternative enforceable schedule with Ecology.

B. The City needs to ensure continued operation and maintenance of the containment and monitoring systems if any portion of the property is sold, leased, transferred or otherwise conveyed.. This requirement is an element of the 1990 consent decree.

C. Notices are needed so that no water supply wells are constructed and used in areas with groundwater contamination emanating from the landfill.

- The City will annually notify the Seattle-King County Department of Public Health, Ecology, the local water districts (currently, the Kent and Highline Water Districts) and locally active well drillers in writing of groundwater conditions in the affected areas downgradient of the landfill. This notice will include a map showing the location of the affected areas and indicate which aquifers are affected and their elevations. This information shall be updated annually and can be part of an annual groundwater monitoring report. Locally active well drillers are all well drillers that have drilled wells within King County in the year prior to the notice. Ecology will provide the list of locally active well drillers to the City. This requirement for annual notices can be removed or modified by Ecology after groundwater cleanup standards have been met in the groundwater monitoring wells downgradient from the landfill.
- The City of Seattle will also annually notify owner of Well #37 (See figure 6-1) in writing of groundwater conditions in the area of the well. Alternatively, the City of Seattle can provide to Ecology adequate assurances that this well has been properly abandoned.

As an additional protection, state regulations forbid any private drinking water wells within 1,000 feet of a municipal landfill or 100 feet from all other sources or potential sources of contamination (WAC 173-160-171). State regulations (WAC 173-160-151) also requires a property owner, agent of that owner, or a water well operator to notify Ecology of their intent to begin well construction prior to beginning work. This notification can provide notice to Ecology if anyone plans to build a new water well too near Midway Landfill.

Ecology will continue to be the lead regulatory agency overseeing the performance of the selected remedial action by the City of Seattle. However, if necessary, EPA could use its statutory authority to ensure that actions selected by this ROD are implemented.

The groundwater cleanup standards for the current contaminants of concern can be found in Table 8-1. If other contaminants resulting from releases from the landfill are found in any down gradient monitoring well, cleanup levels will be established for these additional contaminants using the federal drinking water standards and MTCA.

The point of compliance for the groundwater will be at the edge of the landfill waste as specified in a Compliance Monitoring Plan to be approved by Ecology. Under MTCA, this location is considered a "conditional point of compliance." All groundwater downgradient of this point of compliance will need to meet these cleanup levels for contaminants resulting from releases from the landfill before the Midway Landfill is removed from the Superfund National Priorities List.

One of the City of Seattle's concerns is that contaminated groundwater is coming into the landfill from up gradient sources, and that this in-coming contaminated groundwater will never allow the groundwater leaving the landfill to meet the groundwater cleanup standards. Because of the major improvements in downgradient water quality in the last ten years, EPA believes it is possible that the groundwater leaving the landfill will eventually meet the groundwater cleanup standards. However, if in the future the City wants to demonstrate that it is technically impracticable for them to meet the cleanup standards at every downgradient well because of the up gradient sources, EPA and Ecology will work together with the City to determine what information is needed to support such a demonstration.

Because the selected remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted under CERCLA within five years of this Record of Decision to ensure that the remedy continues to be protective of human health and the environment. Because Ecology is expected to continue to be the lead regulatory agency for this cleanup, EPA would expect Ecology to perform the five year review at this site.

The City of Seattle estimates that the closure costs of Midway Landfill amounted to about $56.5 million as of 1995. This does not include the ancillary costs associated with the landfill such as the "Good Neighbor Policy" (See Section 3.) In recent years, the budgeted and actual operation and maintenance costs have ranged from $432,000 to $535,600 annually. This amount includes monitoring costs.

11.3 Expected Outcomes of the Selected Remedy

This section presents the expected outcomes of the selected remedy in terms of resulting land and groundwater uses.

All future land use at the landfill must be designed and implemented in a manner that will maintain the integrity of the remedy required under the 1990 consent decree. A number of future land uses have been suggested by Midway Citizens Advisory Committee, working with the Cities of Kent and Seattle in 1992. While this selected remedy clarifies the legal notices that need to be in place to ensure the long-term effectiveness of the containment systems, the selected remedy does not place any additional limits on future land use at the Midway Landfill site and does not change the feasibility of the possible future uses suggested by the Advisory Committee.

Groundwater use directly under the landfill will always be restricted. Once the groundwater downgradient from the landfill meets the cleanup standards established in this ROD, nothing in this selected remedy would forbid use of this groundwater for drinking water. The cleanup levels selected in this ROD are either equal to or more stringent than the federal MCLs. However, state and local regulations place other limits on the use of the groundwater. For example, state regulations forbid any new private drinking water wells within 1000 feet of a municipal landfill.

12. Statutory Determinations

12.1 Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by a combination of engineering and institutional controls. The engineering controls that have been constructed at Midway Landfill by the City of Seattle have been effective in containing gas migration and leachate release from the landfill. This effectiveness is demonstrated by the City's gas monitoring results and by the decreasing water levels in and below the landfill and the decreasing concentration of hazardous substances in the groundwater downgradient from the landfill. The selected remedy will ensure long-term protectiveness by requiring that the containment systems remain effective, that monitoring will continue and be adjusted as necessary, and by clarifying and improving the institutional controls associated with the site and the remedy to ensure that no one will be exposed to the contents of the landfill nor to contaminated groundwater. Implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts.

12.2 Compliance with Applicable, or Relevant and Appropriate Requirements

The selected remedy for Midway Landfill will comply with all federal and state ARARs. The chemical-, action-, and location-specific ARARs are as follows:

The Washington Model Toxics Control Act (MTCA) Cleanup Regulations (Chapter 173-340 WAC) are applicable. In particular, MTCA is applicable to the determination of the order of preference of cleanup technologies (WAC 173-340-360(4)), to require the provision of a reasonable restoration time frame (WAC 173-340-360(6)), the establishment of groundwater cleanup levels (WAC 173-340-720(3)), selection of the point of compliance (WAC 173-340-720(6)), the determination of attainment of the groundwater cleanup level when the practical quantitation limit is greater than the cleanup level (WAC 173-340-707), and the format of the institutional controls (WAC 173-340-440.)

Certain landfill closure and post-closure requirements in the Washington Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC) and in the Washington Minimum Functional Standards for Solid Waste Handling (Chapter 173-304 WAC) are relevant and appropriate. Specifically, the notation on the deed requirement in WAC 173-351-500 (1)(I) and the minimum functional standard for explosive landfill gas in WAC 173-304-460(2)(b) are relevant and appropriate.

The primary federal drinking water standards (40 CFR 141), known as the MCLs, established under the Safe Drinking Water Act, are relevant and appropriate to the establishment of the groundwater cleanup standards downgradient of the landfill.

12.3 Cost-Effectiveness

The costs of the selected remedy are proportional to its overall effectiveness. The costs of this remedy are similar to the costs of the no action alternative, but provide better long term protectiveness.

12.4 Utilize Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions to the maximum extent practical. EPA's presumptive remedy for municipal landfills is containment. Ten years of monitoring data show that the containment remedy has been successful in reducing the risks and exposures from the site. The selected remedy helps ensure that the containment remedy will continue to be protective.

12.5. Preference for Treatment as a Principal Element

The selected remedy at Midway Landfill satisfies the statutory preference for treatment as a principal element of the remedy. Extracted landfill gas is flared as part of the existing landfill gas collection system. During the RI, numerous hazardous substances were found in the extracted landfill gas including vinyl chloride, xylenes, toluene, benzene and other solvents.

12.6 Five year reviews

Because this remedy will result in hazardous substances remaining above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years of this Record of Decision to ensure that the remedy continues to be protective of human health and the environment.

13. Documentation of Significant Changes from the Preferred Alternative in the Proposed Plan

There are no significant changes between the preferred alternative described in the proposed plan and the remedy selected in this ROD

The following minor changes have been made from the preferred alternative in the proposed plan:
- An additional RAO has been added to clarify that returning groundwater downgradient of the landfill to drinking water and state cleanup standards is a goal of this remedial action.
- The ROD clarifies that details of the landfill monitoring program have been established by Ecology and the City of Seattle in a compliance monitoring plan. The proposed plan implied that Ecology would establish the details unilaterally.
- The selected remedy includes a minor changes to the institutional control requirements for notification of well drillers. The notice will be provided to well drillers that have been recently active in King County. Ecology will provide the list of locally active well drillers to the City of Seattle.
- The ROD does not contain the statement that Ecology determines when the site meets cleanup levels. The City can contact both Ecology and EPA when the City believes the site has met all of the requirements of this ROD and thus could be considered for deletion from the NPL.
- The remedy selected in this ROD has an added requirement that the City annually notify the owner of one off-property well, unless the City provides Ecology adequate assurances that this well has been properly abandoned. At the time of the proposed plan, the staff writing the proposed plan were not aware that this well existed, even though the information was in the administrative record.

These changes are a logical outgrowth of the information presented in the proposed plan and in the administrative record.